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(54) Security systems

(57) A security system makes use of a personal communications network which comprises mobile units whose location and operating status is continuously monitored by a control unit (3) in a network control centra via geographically-arrayed radio cells comprising respective network transmit-receive devices (2).

When an alarm device (11) detects an alarm condition, it switches a modified mobile unit (1') of the network from a standby operating condition to the active operating condition. This is detected by the control unit (3) which establishes in accordance with an identification signal transmitted by the mobile unit (1') that the unit is in use as part of the security system and the identification signal is indicative of an alarm condition. Thereafter, the control unit causes appropriate information, stored in the control unit itself and/or in slave computers (13, 14, 15) remote from the control centre, to be displayed by those computers or on a dedicated security VDU (12). The control unit (3) also supplies information concerning the location of the cell from which the identification signal was transmitted, and so the location of the vehicle. Thus all this information need not be transmitted from the alarm device location. Non-mobile units may be used.

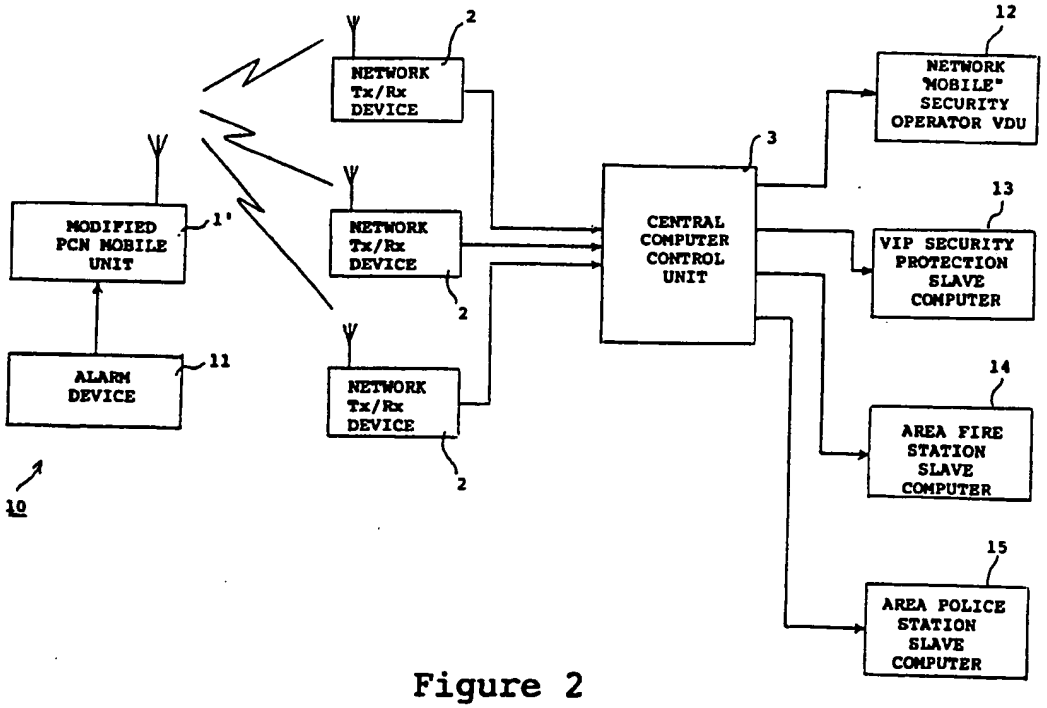

Figure 2

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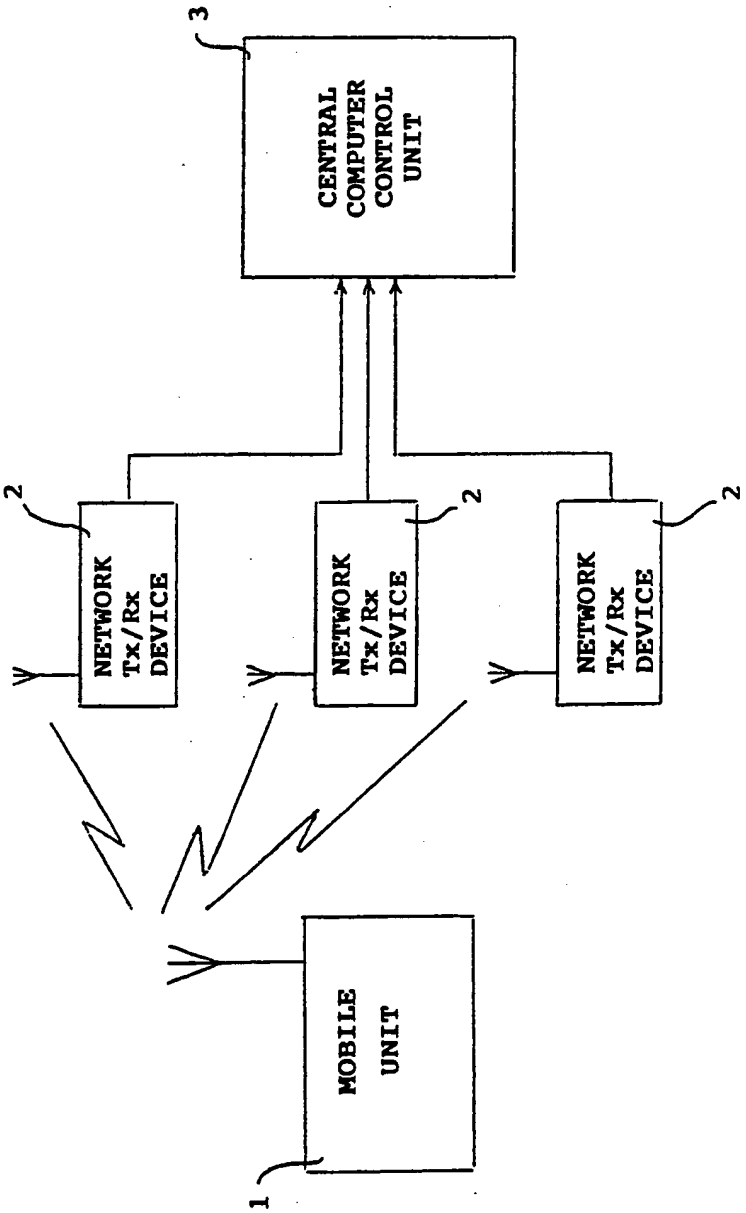
3
CENTRAL COMPUTER CONTROL UNIT
2
NETWORK Tx/Rx DEVICE
2
NETWORK Tx/Rx DEVICE
2
NETWORK Tx/Rx DEVICE
MOBILE UNIT
1

Figure 1

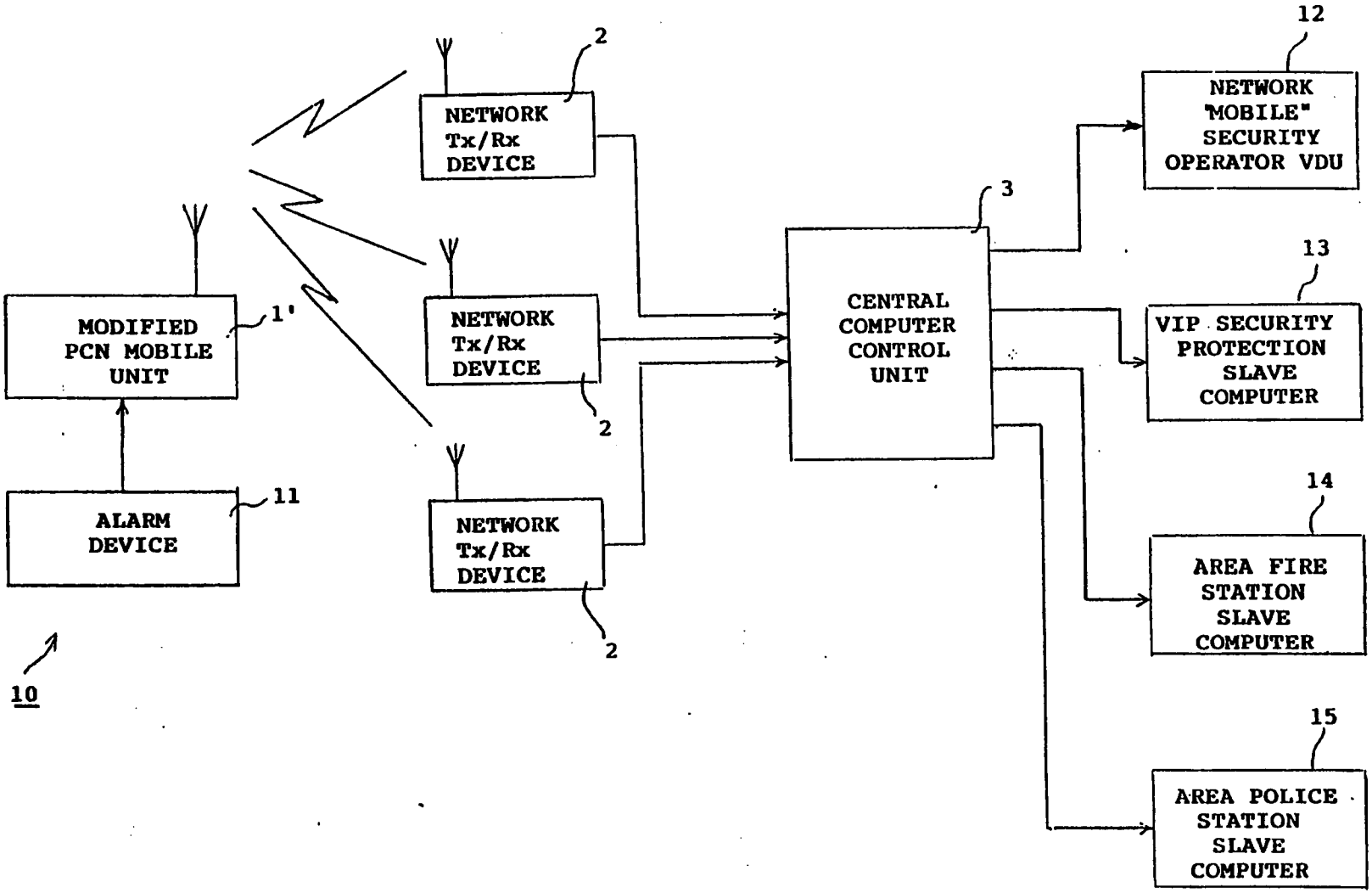
MODIFIED PCN MOBILE UNIT
1'
ALARM DEVICE
11
10
NETWORK Tx/Rx DEVICE
2
NETWORK Tx/Rx DEVICE
2
NETWORK Tx/Rx DEVICE
2
CENTRAL COMPUTER CONTROL UNIT
3
NETWORK "MOBILE" SECURITY OPERATOR VDU
12
VIP SECURITY PROTECTION SLAVE COMPUTER
13
AREA FIRE STATION SLAVE COMPUTER
14
AREA POLICE STATION SLAVE COMPUTER
15

Figure 2

SECURITY SYSTEMS

The present invention relates to security systems, and in particular to security systems for vehicles or fixed entities having a radio transmitting device connected to an alarm system.

Various security systems have been proposed which employ the combination of an alarm device, such as a burglar alarm, and a communications device, such as a telephone, in order to detect a predetermined alarm condition and notify an operator at a remote location of the existence of the alarm condition.

In one such system, proposed in UK patent number 2191365, at a building or in a vehicle to be protected recording means such as a conventional audio tape recorder are connected with the communications device, for providing a pre-recorded message identifying the vehicle or building, together with other details (for example location) for enabling the operator to respond to the alarm condition. An autodialler unit is provided for causing the communications device to transmit the pre-recorded message to the operator on a predetermined emergency number when the alarm condition is detected by the alarm device. The above system, however, requires a relatively complex interaction between an autodialler unit, recording means, and a communications device, in addition to associated control means (comprising, for example, a microprocessor) making the system undesirably costly, potentially unreliable, as well as bulky and hence obvious to those against whom the system is directed. Furthermore, the system is generally inconvenient to use and highly vulnerable to inadvertent misuse or deliberate attempts to disable it. In particular, because of the time taken by the autodialler unit to dial the predetermined emergency number of the operator and the additional time required for transmission of the pre-recorded message, a thief, becoming aware of the existence of the system could

easily prevent all or part of the alarm message from being transmitted. A further problem can arise if a breakdown in communication occurs or if there is a significant noise component in the communication channel during autodialling or during subsequent transmission of the pre-recorded message such that incomplete or inaccurate information is received by the operator.

According to a first aspect of the present invention, there is provided a security system for an entity having a radio transmitting device, the system comprising:

alarm means, connected to the said radio transmitting device, for detecting a predetermined alarm condition and upon such detection for causing the said radio transmitting device to transmit an identification signal, consisting of identification information identifying the device, the said radio transmitting device being operable as part of a communications network having a control unit operable to receive the said identification signal and to derive therefrom the said identification information and then to establish in accordance with that information whether or not the said identification signal is indicative of such an alarm condition; and

data storage and display means, connected with the said control unit, for storing at a location separate from the entity further information required to enable a response to the said alarm condition to be provided and for automatically making such further information available to an appropriate operator of the system if it is established that the said identification signal is indicative of the alarm condition, whereby such further information need not be transmitted from the entity when the said alarm condition is detected.

Such a system is particularly suitable for use in a fixed entity such as a building, since in this case the further information required by the operator to respond

to a detected alarm condition is fixed, comprising the location of the building and, for example in the case of a fire alarm system, details of dangerous chemicals stored in the building. Because this further information is stored in the network control unit (or in a special emergency coordinating unit connected to the control unit), only identification information need be transmitted from the entity on detection of an alarm condition. Accordingly, less information is required to be transmitted from the entity and the security installation at the entity can be simplified, whereby the overall reliability of the security system is improved.

It will be appreciated that a system embodying the aforesaid first aspect of the invention is also applicable to vehicles, although in such a case the location of the vehicle will clearly vary. In certain applications, for example when the system is applied to a goods vehicle following a short fixed route or to a vehicle which is parked for prolonged periods at a fixed location, such a system can provide an acceptable degree of protection. However, in those applications in which the vehicle to be protected is highly mobile, additional information concerning the current location of the vehicle, updated regularly in accordance with the movement of the vehicle, is required to ensure that an effective response to an alarm condition can be provided by the emergency operator.

GB-A-2220778 describes a more specialised vehicle system, broadly comparable to the above-discussed system disclosed in GB-2191365 and employing a cellular telephone mobile unit as the communication device, in which such additional variable location information must be periodically updated by the vehicle user. The last-updated information is then incorporated as part of the pre-recorded message transmitted (as before) to the emergency operator on the predetermined number provided by an autodialler unit. In this proposed system,

however, the vehicle user must himself periodically update the location information (being regularly prompted to do so by a beeper device), and the system is therefore limited in its usefulness in a situation in which the "user" of the vehicle is a thief, joyrider or hijacker, who will be alerted to the presence of the alarm device by such regular prompting and can then either render the system inoperative or provide confusing or false location information. In an attempt to address this problem, GB-A-2220778 also discloses an enhanced system in which the alarm message further comprises (in addition to the location information) distance information, derived from the vehicle odometer, indicating the distance travelled by the vehicle since the location information was last updated by the user. The inclusion of such distance information in the alarm message is also of limited practical value, however, since in the proposed system it is not accompanied by information relating to the direction in which the vehicle has travelled since that location information was recorded. The system concerned also suffers from the same disadvantages as those mentioned above, with reference to the security system proposed in GB-2191365.

According to a second aspect of the present invention there is provided a security system for use in a vehicle having a radio transmitting device, the system comprising:

alarm means, connected to the said radio transmitting device, for detecting a predetermined alarm condition and upon such detection for causing the said radio transmitting device to transmit a predetermined signal;

the said radio transmitting device being operable as part of a cellular communications network having a control unit operable to receive the said predetermined signal and to monitor the location of the said device such that information concerning the location of the

vehicle is continuously available at the control unit, whereby such information need not be included in the said predetermined signal transmitted by the device on detection of the said alarm condition.

In a preferred system, after detection of the alarm condition the device can be continuously tracked by the control unit.

A system embodying the aforesaid first and/or second aspect of the invention can be realised by employing a cellular communications network known as a personal communications network, as described hereinafter.

Incidentally, it is mentioned in GB-A-2220778 that if a vehicle is fitted with a radio transmitting device for use in such a cellular network, it is possible for an operator in a control unit of the network to establish the location of the radio transmitting device (cellular telephone mobile unit) to within a single cell of the network.

However, as noted above, the vehicle security systems proposed in that document rely exclusively upon the vehicle user to provide the location information (possibly supplemented by information derived from the vehicle odometer) and the document is accordingly only concerned with ways of ensuring that such variable location information is entered regularly by the vehicle user so that reasonably accurate location information can be incorporated in the alarm message transmitted from the vehicle to the remote emergency operator. No use is made of the location information available by virtue of the cellular nature of the network. In a system embodying the aforesaid second aspect of the invention no location information whatsoever is included in the signal transmitted from the vehicle on detection of an alarm condition, so that this signal can be shorter and hence more quickly and reliably transmitted.

According to a third aspect of the present invention, there is provided a method of employing a

communications network to provide an alarm-monitoring facility, the network having a plurality of radio transmitting devices respectively operable in an active operating condition to transmit an identification signal consisting of identification information, identifying the device, to the control centre, there being within the said plurality a set of such devices connected respectively to alarm means, for detecting a predetermined alarm condition, so that detection of the said alarm condition by the alarm means places the device connected thereto in the said active operating condition;

in which method the devices of the said set are respectively allocated identification information that distinguishes them from the remaining devices of the said plurality not belonging to the said set, whereupon when such an identification signal is received from one of the devices of the said plurality control means of the control unit are employed to derive from that identification signal the said identification information allocated to the said one device and to establish in accordance therewith whether or not the said identification signal is indicative of such an alarm condition.

Reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 shows a block diagram of a cellular communications network; and

Figure 2 shows a block diagram of a security system embodying the present invention.

The security system shown in Figure 2 makes use of the cellular communications network shown in Figure 1, and accordingly before describing the Figure 2 system a brief outline of the communications network shown in Figure 1 will be given. Further details of this network may be found, for example, in Personal Communications Networks, Ramsdale P.A., IEE Colloquium on 'Customer Access' (Digest No. 038), IEE London, 1990.

The cellular communications network shown in Figure 1 is known as a personal communications network (PCN), which is intended to provide a cellular communications network in which each user (or subscriber) of the network has a truly mobile two-way radio communications device 1, known as a mobile unit, by means of which that user can be contacted anywhere within the coverage area of the network. Each mobile unit of the network is allotted a unique identification number, known as a user or subscriber number, such that the user can both make and receive calls in much the same way as with a conventional fixed-location telephone handset.

As in conventional cellular networks, the personal communications network comprises a plurality of cells, each of which includes a radio transmitting and receiving device 2, known as a network transmit-receive device, operable to route both incoming calls to, and outgoing calls from, any mobile unit 1 currently within the cell.

The network is controlled by a central computer control unit 3, located in a control centre of the network and connected to each of the network transmit-receive devices 2. To enable a call to be routed through to a desired mobile unit 1 without significant "searching" delays, the control unit 3 continuously monitors the location and operating status of each mobile unit 1 such that the control unit is constantly aware of the cell in which each mobile unit 1 is presently located and its operating status (i.e. whether the mobile unit is in a standby operating condition, known as the on-hook condition, in which the unit is not in use and is hence able to receive an incoming call, or in an active operating condition, known as the off-hook condition, in which the unit is in use during a call).

To facilitate such monitoring the network employs a number of automatic "handshakes" in which digital information is exchanged between the mobile unit 1 and the network transmit-receive device 2 of the cell in

which the mobile unit is presently located. During a "handshake" procedure the mobile unit transmits a digital signal (known as a bit stream), identifying the subscriber number allotted to the mobile unit, and providing information concerning the operating status of the mobile unit.

When a user wishes to make a call using his mobile unit, the unit is placed in the active operating condition (the off-hook condition) by engaging a pushbutton on a control panel of the mobile unit or simply by lifting a hand-held receiver from its associated cradle if the unit is of the conventional two-piece telephone construction. This active operating condition is detected in the central computer control unit 3 in accordance with a change in the bit stream transmitted (as part of the above-mentioned handshake procedure) from the mobile unit to the network transmit-receive device 2 of the cell in which the mobile unit is located.

The security system shown in Figure 2 makes use of a cellular communications network such as the personal communications network described above, and in Figure 2 components of the personal communications network have the same reference numerals as those used in Figure 1. Each mobile unit 1' for use in the security system of Figure 2 is, however, modified with respect to the above-discussed standard PCN mobile unit (denoted 1 in Figure 2) such that the modified unit 1' has an input (ACT) to which an activating input signal, used to place the unit 1' in the active (off-hook) operating condition, can be applied.

The security system of Figure 2 includes an alarm installation 10 incorporated, for example, in a vehicle or in a building. The alarm installation 10 includes an alarm device 11, such as a car or burglar alarm or a fire detection device, and one of the aforesaid modified mobile units 1' of the personal communications network.

The alarm device 11 has an output (ALARM) connected to the input (ACT) of the mobile unit 1'.

The security system of Figure 2 also includes a number of further devices 12 to 15 connected to the control unit 3 in the control centre of the personal communications network. Of these devices, an operator's VDU 12, known as the network mobile security operator VDU, may be located in the control centre itself or can be located remote from the control centre in, for example, a specialised emergency co-ordinating centre. A slave computer 13, known as the VIP slave computer, is located at the headquarters of a security service, for example, at Scotland Yard or at the Ministry of Defence. In addition, further slave computers 14 and 15 are located at local emergency coordinating centres such as area fire and police stations from which fire and police emergency service for a particular locality are directed. Any number of such slave computers 14 and 15 can be provided in different respective area fire and police stations.

The slave computers 13 to 15 can comprise, for example, conventional personal computers and store alarm response information needed to enable an effective response to a detected alarm condition to be provided. Thus, for example, the slave computer 14 in an area fire station stores the address of the building etc. at which the alarm installation 10 is located, together with details of any dangerous chemicals stored in the building.

Additional alarm response information required by the control unit 3, for example to enable the control unit 3 to establish the most appropriate are fire or police station to provide the alarm response, is held within the control unit itself. In addition, since the VDU 12 does not store any alarm response information the information displayed thereby is necessarily derived from the control unit, and typically comprises information

enabling a security operator using the VDU to identify the alarm installation at which an alarm condition has been detected (for example the registration number, make and colour of a vehicle, and details of its owner).

Operation of the Figure 2 security system will now be described.

As mentioned above, in the personal communications network each mobile unit is allotted a unique identification number, known as the subscriber number. To enable the control unit 3 of the network to distinguish between standard (unmodified) PCN mobile units and modified units 1' for use in alarm installations, a set of subscriber numbers (for example, all numbers beginning with the digits 070) is allocated to the modified mobile units 1'. In addition, to enable the control unit 3 to distinguish between different types of alarm installation, different respective sets of subscriber numbers are allocated to different types of alarm installation. Thus, in the Figure 2 system a first set of subscriber numbers (having, for example, the prefix 0701) is allocated to mobile units used in vehicle alarm installations. A second set of subscriber numbers (having, for example, the prefix 0702) is allocated to mobile units used in VIP security protection systems. Similarly, a third set of numbers is allocated to mobile units used in fire alarm installations, and a fourth set is allocated to domestic (burglar) alarm installations.

In use of the security system of Figure 2, upon detection of a predetermined alarm condition, for example, an outbreak of fire or the presence of an intruder, at the alarm installation 10, the alarm device 11 sends the aforesaid activating input signal from its output (ALARM) to the activating input (ACT) of the mobile unit 1', thereby placing the mobile unit 1' in the active (off-hook) operating condition.

When, during routine monitoring of the location status of each mobile unit of the network it is

determined by the control unit 3 in the control centre (by means of a change in the bit stream received from that mobile unit via the appropriate network transmit-receive device 2) that one of the mobile units is in the active (off-hook) condition , the control unit 3 automatically derives from the bit stream concerned the subscriber number of the activated mobile unit and then checks to establish whether that subscriber number belongs to one of the aforementioned sets of subscriber numbers allocated to alarm installations.

If it is found that the subscriber number concerned belongs to one of these sets it is immediately established that an alarm condition has been detected at the alarm installation associated with that mobile unit 1'. In accordance with the particular set to which the received subscriber number is found to belong, the control unit 3 then sends relevant information to one of the devices 12 to 15 appropriate for the alarm condition.

Thus, if it is established that the received subscriber number belongs to the aforesaid first set (corresponding to vehicle security installations) the central computer control unit 3 sends to the network mobile security operator VDU 12 the details of the vehicle registration number, colour stored, etc stored in the control unit, together with location information, such as, for example, the geographical location of the cell of the network in which the mobile unit 1' is presently located.

Accordingly, the location of the alarm installation and hence the location of the vehicle or other mobile entity can be established automatically by the central computer control unit 3 of the network without the need for any intervention by the vehicle user or a security operator. In this respect, since the radio frequencies employed in the personal computer networks are higher then those currently in use in conventional cellular communications networks, the areas of the cells in

personal communications networks are smaller than those of such conventional cellular networks. Indeed, it is envisaged that with personal communication networks there may be several cells in one long street, with the result that the location information provided by the control unit 3 can be very accurate.

In addition, as mentioned above, in the personal communications network such location information is automatically updated by the control unit 3, irrespective of whether the mobile unit 1' remains in the active operating condition, so that it is then possible for a security operator using the VDU 12 to track subsequent movement of the vehicle concerned.

If it is established that the received subscriber number belongs to the second set (corresponding to VIP or military security systems) the control unit 3 automatically transmits information identifying the alarm installation at which the alarm condition has been detected to the slave computer 13 at the headquarters of the appropriate security service, without any intervention by an operator in the PCN control centre which might jeopardize security. The slave computer 13 then automatically alerts an emergency operator at the headquarters and displays the alarm response information stored in the slave computer on a VDU, for example. The communication channel between the control unit 3 and the slave computer 13 can be made desirably secure by known techniques.

If it is established that the received subscriber number belongs to either of the third or fourth sets (allocated to fire alarm and domestic security installations respectively) the control unit 3 determines, in accordance with the additional alarm response information stored in the control unit 3 for each mobile unit 1' belonging to those sets, which area fire or police station is the most appropriate to enable an effective response to the alarm condition to be

provided. As in the case of the VIP security installation the control unit 3 then sends information identifying the alarm installation at which the alarm condition has been detected to the slave computer 14 or 15 in the appropriate area fire or police station.

It will be appreciated that a number of modifications to and omissions from the system of Figure 2 are possible. In particular, communications networks other than the personal communications network can be used, and in a security system in which all of the mobile units have fixed locations, it is not necessary to employ a communications network capable of locating the mobile units of the network, since the fixed location information is held at the communications network control centre or in a special emergency co-ordination centre of the network.

Furthermore, in the system of Figure 2, the off-hook operating condition is used to denote detection of an alarm condition. However, since each mobile unit of the PCN system is operable to continuously provide in its bit stream a number of data bits indicating its operating status (the off-hook condition being merely denoted by the logic level of one particular bit within the bit stream), it is readily possible to utilise other bits within the bit stream to denote the alarm condition. It would be possible, for example, to allocate a unique "alarm" bit within the bit stream for this purpose. This would make it possible to use a single PCN mobile unit for both security and ordinary applications, thereby reducing costs. In such a case, an alarm input and/or "panic" button could be provided to cause the alarm bit to be set and hence signal the alarm condition.

The use of slave computers is not essential, since all of the alarm response information could alternatively be stored at the control centre (together with certain information necessarily held at the control centre for billing purposes for example), but the use of separate

slave computers has the advantage that confidential alarm response information (particularly for VIP/military systems) can be held in a secure establishment independent of the network control centre.

CLAIMS:

1. A security system for an entity having a radio transmitting device, the system comprising:

alarm means, connected to the said radio transmitting device, for detecting a predetermined alarm condition and upon such detection for causing the said radio transmitting device to transmit an identification signal, consisting of identification information identifying the device, the said radio transmitting device being operable as part of a communications network having a control unit operable to receive the said identification signal and to derive therefrom the said identification information and then to establish in accordance with that information whether or not the said identification signal is indicative of such an alarm condition; and

data storage and display means, connected with the said control unit, for storing at a location separate from the entity further information required to enable a response to the said alarm condition to be provided and for automatically making such further information available to an appropriate operator of the system if it is established that the said identification signal is indicative of the alarm condition, whereby such further information need not be transmitted from the entity when the said alarm condition is detected.

2. A security system for use in a vehicle having a radio transmitting device, the system comprising:

alarm means, connected to the said radio transmitting device, for detecting a predetermined alarm condition and upon such detection for causing the said radio transmitting device to transmit a predetermined signal;

the said radio transmitting device being operable as part of a cellular communications network having a control unit operable to receive the said predetermined signal and to monitor the location of the said device

such that information concerning the location of the vehicle is continuously available at the control unit, whereby such information need not be included in the said predetermined signal transmitted by the device on detection of the said alarm condition.

3. A method of employing a communications network to provide an alarm-monitoring facility, the network having a plurality of radio transmitting devices respectively operable in an active operating condition to transmit an identification signal consisting of identification information, identifying the device, to the control centre, there being within the said plurality a set of such devices connected respectively to alarm means, for detecting a predetermined alarm condition, so that detection of the said alarm condition by the alarm means places the device connected thereto in the said active operating condition;

in which method the devices of the said set are respectively allocated identification information that distinguishes them from the remaining devices of the said plurality not belonging to the said set, whereupon when such an identification signal is received from one of the devices of the said plurality control means of the control unit are employed to derive from that identification signal the said identification information allocated to the said one device and to establish in accordance therewith whether or not the said identification signal is indicative of such an alarm condition.

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